

AGRIBUSINESS GROUP PAPER

ABSTRACT

Agribusiness is a critical component of U.S. commerce. In fact, some have argued that agribusiness is as politically and strategically important to the U.S. as oil is to the Middle East. Agribusiness is a diverse industry that feeds the nation and resources the national strategy. While U.S. agribusiness is the world's leader, it is challenged by global competition and dynamic changes in technology and structure. The security posture of the United States depends on a safe, reliable, and plentiful global food supply. U.S. national security strategists must recognize the industry's global role, and the challenges facing this vital industry.

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PLACES VISITED

Domestic:

AG-Pro of Stuttgart (John Deer dealership), Stuttgart, AR
American Food Service, Dallas, TX
Biad Chile Extraction Plant, Radium Springs, NM
BIO: Biotechnology Industry Organization, Washington, DC
Cargill Inc., Reserve, LA
Catfish Institute, Belzoni, MS
Central Intelligence Agency, Langley, VA
Chicago Board of Trade, Chicago, IL
Cobb-Vantress, Inc. Siloam Spring, AR
Columbia Grain International (CGI) Grain Terminal, Portland, OR
Crittenden Gin Company, Clarkedale, AR
DB Foods, Springdale, AR
Delmarva Poultry Justice Alliance, Delmarva, MD
Dundee Packing House, Dundee, FL
Fabian Garcia Farm and Chile Institute, Las Cruces, NM
Federal Compress and Warehousing, Memphis, TN
Federal Reserve Bank of Chicago, Chicago, IL
Fishbelt Feeds, Inc., Moorhead, MS
Fishhawk Fisheries, Astoria, OR
Florida Dept. of Citrus, University of Florida, Gainesville, FL
Florida Natural Processing Facility & Grove Center, Lake Wales, FL
George's, Inc., Springdale, AR
Heartland Catfish (processing plant), Itta Bena, MS
Heineman's Bakery, Chicago, IL
Helm's Farms, Clarkedale, AR
Hohenberg Brothers Company, Memphis, TN
International Paper Container Facility, Springhill, LA
International Paper Conversion and Distribution Facility, Springhill, LA
International Paper Mansfield Mill, Mansfield LA
International Paper Operations, Memphis, TN
International Paper Pre-Print Facility, Shreveport, LA
International Paper SHARD Project, Springhill, LA
International Paper Wood Products Division, Springhill, LA
Joe Lopez Farms, Las Cruces, NM
Lake Alfred Research Facility, Lake Alfred, FL
Las Uvas Dairy, Salem, NM
Nabisco Inc., Chicago, IL
National Cotton Council, Memphis, TN
National Marine Fisheries Service, Southeast Region Office, St. Petersburg, FL
New Hampshire Fishery, Manchester, NH
New Mexico Farm and Ranch Heritage Museum, Las Cruces, NM

New Mexico State University College of Agriculture and Home Economics,
Las Cruces, NM
New Orleans Cold Storage, New Orleans, LA
Newly Weds Foods, Springdale, AR
NGFI Corn Milling K-2 Plant, Convent, LA
Northwest Food Processors Association, Portland OR
Nunn Ranch, Deming, NM
Pacific Marine Fisheries Management Council, Portland, OR
Peavey Company, Paulina, LA
Perdue Processing, Salisbury, MD
Pinnacle Food Corporation, Springdale, AR
Port of New Orleans, New Orleans, LA
Port of South Louisiana, LaPlace, LA
Portland Maine Fishery, Portland, ME
Riceland Foods, Stuttgart, AR
Silocaf of New Orleans, Inc., New Orleans, LA
Southeast Fisheries Science Center, Miami, FL
Southwest Fisheries Science Center, La Jolla, CA
Southern Cotton Oil, Memphis, TN
SYSCO Corporation, Houston, TX
SYSCO Food Services of Houston, LP, Houston, TX
Tackett Farms, Indianola, MS
The Folger Coffee Company, New Orleans, LA
Tyson Foods, Inc., Springdale, AR
U.S. Agency for International Development, Washington, DC
U.S. Coast Guard Air Station, Cape Cod, MA
U.S. Coast Guard Group, Portland, ME
U.S. Coast Guard Group/Air Station Astoria, Warrenton, OR
U.S. Coast Guard Marine Safety Office, Portland, ME
U.S. Coast Guard Station, Marine Safety Office/Group Portland, OR
U.S. Dept. of Agriculture, Agricultural Research Service, Beltsville, MD
U.S./Mexico Port of Entry, Santa Teresa, NM
United Nations High Commissioner for Refugees, Washington, DC
University of Arkansas, Poultry Science, Fayetteville, AR
USDA Rice Research Center, Stuttgart, AR
Williamette River and Port of Vancouver, Vancouver, OR
Woods Hole Fishery, Woods Hole, MA
Woods Hole Oceanographic Institution, Woods Hole, MA
World Bank, Washington, DC

International:

Agricultural Research Council Infruitec-Nietvoorbij, Capetown, South Africa
Agricultural Research Council - Roodeplaat, Elsenburg, South Africa
AgriPAC Consultores, Buenos Aires, Argentina
Biotechnology Division, Dept of Economic Affairs, Dept of Agriculture and Tourism
Western Cape, Capetown, South Africa
Bodega y Cavas de Weinert S.A., Buenos Aires, Argentina
Fresh Produce Terminals, Capetown, South Africa
Giraldi Dairy Farm, Chilcoy, Argentina
Hartenberg Estate, Stellenbosch, South Africa
LASO, S.A., Buenos Aires, Argentina
Member, South African Parliament, African National Congress Whip,
Capetown, South Africa
Member, Western Cape Provincial Parliament, Capetown, South Africa
Plaisir De Merle, Simondium, South Africa
U.S. Embassy, Agricultural Counselor, Buenos Aires, Argentina
Western Cape Investment and Trade Promotion Agency (WESGRO),
Capetown, South Africa

INTRODUCTION

Based on the production of food and fiber, agribusiness is a critical and complex industry defined by a cycle linking suppliers to consumers. Included in this cycle are the many industries that identify today's highly competitive agribusiness environment. Throughout this cycle, nations and multinational companies vie for market share. In order to obtain competitive advantage, agribusinesses must focus on price and value-added products that meet consumer preferences and desires.

In today's global agricultural market, political conditions play a larger role than ever before. As a world leader, the United States has a stake in the agricultural problems of other nations, and must address agricultural policies in consonance with those nations. Political decisions like U.S. farm policy, trade agreements, tariffs, or sanctions can encourage or discourage world trade and stability.

Founded on a safe, secure, and plentiful food supply for our nation and the world, American agribusiness is a cornerstone of our national security posture. This paper explores the role of agribusiness as an element of national power and its role in the U.S. national security strategy.

AGRIBUSINESS DEFINED

Two Harvard economists, John Davis and Ray Goldberg, first coined the term "agribusiness" in 1957. They defined agribusiness as "the sum total of all operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing and distribution of farm commodities and the items made from them."¹ This definition established the concept of agriculture as an industry that goes beyond the growing of crops and raising of animals. The concept of agribusiness has evolved over the past 35 years, and there are now many definitions, but what perseveres is the recognition of the breadth and depth of the agribusiness industry.

For the purposes of this paper, agribusiness encompasses the chain of industries directly and indirectly involved in the production, transformation and provision of food and fiber. As such agribusiness comprises the following sectors: researchers, suppliers, growers, distributors, processors, service providers, and retailers.

CURRENT CONDITION OF AMERICAN AGRIBUSINESS

The overall state of American agribusiness is good and is a large segment of the U.S. economy. The agribusiness industry generates roughly 24 million jobs nationwide and constitutes about 16.5 percent of U.S. Gross Domestic Product (GDP).² Dramatic changes in product characteristics, worldwide production and consumption, technology, operation size, and geographic location characterize the industry today. Despite challenges from foreign competition, low commodity prices, and increasing production costs, the United States is the world leader in agribusiness. Forecasted domestic farm cash receipts in calendar year 2001 were \$205.5 billion, up from \$193.6 billion in 2000. This figure includes \$97 billion in crop receipts and \$108.5 billion for livestock. Net farm income in 2001 was approximately \$49.4 billion. This figure includes \$20 billion in

revenue from government subsidies. Forecasted 2002 net farm income is \$40.6 billion, benefiting from 10.7 billion in government payments.³

U.S. agribusiness serves a mature domestic market that enjoys excess capacity in most commodities. Future growth in domestic markets will be demand-limited. Conversely, the agribusiness industry is well positioned to take advantage of future increases in worldwide food demand. While American exporters have experienced reduced demand for some commodities—with some former customer nations producing increasing shares of their own food—demand in developing countries for protein rich foods is growing. In 2001, the world's population reached 6.1 billion. By 2010, world population will rise to an expected 6.9 billion.⁴

Increasing protein demand in developing countries combined with rapidly increasing population growth will place ever-growing demands on world agribusiness. American agribusiness is poised to meet this growing demand for food. Historically, the production of bulk commodities provided a plentiful and affordable food supply and served as the backbone of the nation's agricultural system. Today, many of the same forces shaping the global economy influence agribusiness. The United States Department of Agriculture (USDA) identifies four trends that are driving change in the industry and reshaping agribusiness: *consumer-driven agriculture, globalization of markets and culture, technological innovation, and agricultural diversity (characterized by the consolidation and integration of markets)*.⁵ Together these trends cause a shift from our commodity-based, surplus-oriented production focus to one defined by products, services, markets, and consumers.

A Consumer-Driven Market

Increasingly, consumers define the food market. Changes in consumer preferences have resulted in declining markets for certain products and increasing markets for others. Consumer demand for convenient processed foods and specifically tailored products are at an all time high. Fewer people desire to prepare food on their own. In fact, the USDA estimates that 45% of total U.S. food spending is away from the home.⁶ Food manufacturers, food service operators, handlers, and retailers receive an increasing portion of the American food dollar and farmers receive a decreasing share.

A Global Economy

Better, faster communications and more reliable transportation systems enable agribusinesses to produce, source and sell their products in locations that offer the best competitive advantage. American agribusiness has no borders—it is part of a larger, worldwide, and interconnected system. Today, U. S. food producers compete globally to provide the highest quality products at the best price. Consequently, agribusinesses must diversify their sources of raw materials and buy from the farmer, wholesaler, or food processing company providing the best product for the lowest price at any given time.

Agricultural trade and exports will continue to grow in importance for U.S. agribusiness. The United States enjoys an agricultural trade surplus and should continue to do so in the near-term. The USDA projects U.S. agricultural exports will grow 4.1% annually over the next 10 years, rising from \$50.9 billion to \$76 billion by 2010.⁷

Forecasted agricultural imports will rise 3.1% annually during the same period, resulting in an expected agricultural trade surplus of \$22.6 billion in 2010.⁸

Domestically and internationally, agriculture is subject to quotas, tariffs, and price supports meant to protect domestic production. Often construed as barriers to free trade, the World Trade Organization (WTO) closely monitors these subsidies. The recently signed Farm Security and Rural Investment Act of 2002 (the Farm Bill) modifies current farm legislation to better meet U.S. international trade obligations by automatically reducing farm payments in excess of WTO limits. The new farm bill has generated considerable domestic and international criticism, reflecting the great tension between the desire for free trade and the Congress's desire to protect the vitality of one of America's foremost industries—an industry with special cultural significance.

Technological Innovation

Technological advances have spurred the growth of global markets and shaped the relationships between farmers and agribusiness firms. Traditionally, agricultural technology focused on tools and techniques to lower farm costs and increase yields. Today, advances in biotechnology and information technologies are reducing labor needs, improving production techniques, expanding markets for farmers, and improving communication between producers and consumers. For example, genetically modified seeds can potentially improve yield and better protect crops from insects and weeds. In addition, precision agriculture (a term describing agricultural information technologies used to impact crop production)—with tools ranging from computer-carrying tractors to satellite communications—is increasing efficiency and reducing inputs. Effective use of today's available technologies allows agribusiness leaders to better meet customer needs, leveraging information to build consumer confidence and satisfaction.

Agricultural Diversity

Productivity sparked by technological advances has led to big changes for U.S. agribusiness. Resources are concentrated into fewer and larger farms. While production doubled in the last 50 years, the number of farms dropped by more than two-thirds. Today, about 150,000 American farms produce the majority of our food and fiber.⁹ Approximately two million farmers (who meet the criteria of selling at least \$1,000 worth of products annually) make the balance of agricultural sales. Many of these small farmers also have off-farm occupations. In 1999, net farm cash income for small farmers was \$55.7 billion, while the off-farm portion of their incomes consisted of \$124 billion.¹⁰ Small farms (annual revenue of less than \$250,000) comprised 92% of all farms and 67% of all farmland in 2000.¹¹ Although “family farms” have historically dominated American agribusiness, the number of farms has declined as ownership and production becomes more concentrated to better meet consumer preferences and the demand for food.

CHALLENGES

While the United States is the world leader in agribusiness, it must confront and overcome several substantial challenges in order to maintain that position. These challenges include overcoming threats to food safety, increasing output by trading rivals, and relatively expensive U.S. labor costs as compared to competitors. American agribusiness must also continue to mechanize and take advantage of advances in information technology and biotechnology to compete effectively with emerging agricultural powers.

Food Safety

Assuring the safety of agricultural products is a major challenge facing American agribusiness. Threats to food safety can come from either deliberate or inadvertent actions. Deliberate actions include terrorist and criminal activities such as product tampering while inadvertent actions include the introduction of naturally occurring diseases, contamination and food allergens. The common denominator with respect to food safety incidents is the possibility of widespread fear and decreased competitiveness and profitability.

Since September 11, 2001, the American public has been increasingly concerned about the threat of agriterrorism. Concern was heightened by reports that the terrorists who flew planes into the World Trade Center and Pentagon also investigated utilizing crop dusters to potentially launch chemical or biological attacks. As a result, there is increased awareness throughout the agribusiness industry of the risks of contamination, terrorism and criminal behavior. The industry and the federal government have responded in various ways to the agriterrorism threat. Some firms have increased security to include limiting access, conducting background checks, and employing more security personnel. USDA implemented a biosecurity system designed to prevent the harmful introduction of plant and animal pathogens, placed inspectors on heightened alert at ports of entry and in meat and poultry processing plants, and increased security at its facilities. The federal government also responded with increased funding. For example, the President's FY 2003 budget calls for a 7% increase in funding for the Food and Drug Administration (FDA), Congress approved a supplemental appropriation for the FDA of more than \$151 million and the USDA will receive \$367 million in FY 2003 to bolster biosecurity efforts.¹²

As mentioned previously, terrorist acts are not the only threats to food safety. For example, in recent years, outbreaks of foot and mouth disease and mad cow disease have severely harmed Great Britain's cattle industry.¹³ The threat of cross contamination from genetically modified crops and from foods that produce allergic reactions in the production process are other potential threats to food safety. Approximately three percent of U.S. children and one percent of adults have clinically proven allergic reactions to food products.¹⁴ Allergens are a significant food safety issue because they can cause severe, and sometimes life-threatening, reactions. Due to its importance, this paper contains an essay specifically addressing agriterrorism and food safety.

Technological Advances

American agribusiness has been tremendously effective at adopting technological innovation to improve productivity. For example, production of the nation's 17 largest crops more than doubled between 1960 and 1990. Technological advances were the principal reason for the increase.¹⁵ However, recent advances offer the potential to take agribusiness production to even greater levels. While mechanical advances fueled productivity in the past, today industry is confronting the challenge of effectively leveraging information technology and biotechnology.

Today's farmer has many tools at his or her disposal for the collection, analysis, and application of data. Using these tools, the farmer can pinpoint his location in the field, collect data on that spot, and make informed production decisions. We elaborate on the role of information technology and precision agriculture in an attached essay.

Biotechnological innovations have the potential to increase profitability by increasing crop yields, reducing disease, improving nutrition, and bringing new products to the market.¹⁶ Genetically modified organisms (GMOs) or genetically altered crops have generated controversy within the industry. Several environmental and health concerns have been raised with respect to GMOs. Some fear GMOs are being introduced to the market before being adequately tested for fitness for human consumption. Others fear pest-resistant crops will lead to insects with even greater tolerances. American agribusiness firms are also concerned about trade barriers EU nations have erected with respect to GMOs. Barriers include moratoriums on the import of GMOs and special tracing and labeling requirements to track GMOs.¹⁷

Labor

Human capital (labor) plays a significant role in agriculture. However, while the United States has a strong farming heritage, the nation's farm labor workforce has steadily decreased during the last century. For example, annual farm employment dropped from over 12 million people in 1935 to about 3.3 million people in 2002.¹⁸ Nonetheless, the industry faces several challenges relating to labor. First, U.S. labor costs are relatively expensive. This produces pressure to increase mechanization to decrease costs. It also creates pressure in some sectors of the industry to move operations outside the U.S. to areas with lower costs. Third, American farmers rely to a large extent on migrant workers from other countries. According to a 1997 GAO report, an estimated 600,000 farm workers who were not legally authorized to work in the United States were nevertheless working on American farms.¹⁹ A separate essay will address labor issues in greater detail.

Globalism and Global Competitiveness

Agribusiness faces a period in which trading rivals are producing more and becoming increasingly competitive. This increased competitiveness is balanced in part by a rapidly expanding global population and increasing demand for food. Another challenge is the interconnectedness of agribusiness on a global level. Decisions to subsidize agricultural products in this country inevitably affect other nations. For

example, the government subsidizes U.S. sugar production by offering loans to sugar producers and processors at a pre-established rate and by using a tariff-rate quota (TRQ) to restrict the amount of sugar that can be imported at a low tariff rate.²⁰ The subsidies result in domestic sugar users overpaying and foreign producers benefiting by selling their sugar (limited by TRQ) to U.S. customers at artificially high prices.²¹ Another impact is that sugar import quotas limit the ability of developing countries to export sugar. This restriction on trade hampers the development of poorer nations. According to Nichols Stern, an economist at the World Bank, the "lost export opportunities generated by the subsidies far exceed the amount of foreign aid they receive each year."²²

For many years, one of the basic elements of U.S. grand strategy has been the principle that free and open trade works to secure world peace and prosperity. However, encouraging nations to grow through trade in the world marketplace increases the overall level of global competition. In this environment, the United States faces the challenge of maintaining its domestic economy and remaining a world agribusiness leader while not using tariffs and subsidies that undermine the principle that all nations benefit from free and open trade. Therefore, subsidies and tariffs present a strategic dilemma for the United States.

Feeding the World

As the world's population increases, there is great concern that many in the developing world will be unable to feed themselves. While we believe there is sufficient excess agricultural capacity to feed the world's increasing population, distribution problems and the lack of wealth in developing nations suggest that under nutrition and malnutrition will continue to be a problem and a potential source of conflict. Since September 11, 2001 many foreign policy experts have suggested that poverty and poor nutrition help to create conditions that lead to terrorism and the recruitment of willing terrorists. We explore this issue in the attached essay entitled "World Food Security and U.S. National Security."

OUTLOOK FOR AMERICAN AGRIBUSINESS

Agriculture is as politically and strategically important to the U.S. as oil is to the Middle East. America's vast agricultural resources provide more raw materials than required to meet the nation's basic needs for food and clothing. Blessed with a favorable climate and abundant natural and technical resources, the United States maintains a strategic surge capacity limited only by nature. Further, this nation's economic strength allows us access to markets for essential products the U.S. cannot produce quickly on short notice. For example, more wheat may be required in times of crisis to meet an increased demand for food. American farmers maintain an excess capacity to meet this need. However, because it takes an entire growing season to realize this capacity, we must rely on outside sources to meet shortfalls. Because of an abundance of grain throughout the world combined with its ability to pay, America should be able to meet its food needs in times of peace or crisis.

Outlook

Short-Term. Through improved efficiency, increased production, and global competition, the U.S. farm economy has significantly evolved in structure and organization over the last several decades. The broader agricultural market once characterized by large numbers of buyers and sellers trading commodities on the open market has given way to more efficient *vertically integrated* and *consolidated* markets that deliver safe, healthy consumer-friendly food at lower costs than ever before. Simply put, there are fewer farmers producing more food at lower prices.

Increasingly, farms are consolidating based on cost structure and supply chain connections. Production is changing from family-owned, small-scale, relatively independent farms to larger firms tightly aligned across production and distribution lines. As the trend continues toward fewer commercially-viable farms, we anticipate agribusiness will be increasingly characterized by the consolidation of production into larger and larger units, and integration of production into tightly knit supply chains.

Basic economics is driving the trend towards consolidation. Producers have little or no control over the price received for output. However, producers can control the cost of production. Consolidation is the result of the desire to increase profits by pushing production costs lower. It is common for the average hog farm to have roughly 10,000 animals, chicken farms to house 20,000 chickens per pen, and cattle feedlots contain as many as 300,000 head.²³ In fact, two percent of U.S. feedlots supply three quarters of the cattle.²⁴ In addition, 80% of the broiler production in the U.S. comes from farms with more than 300,000 chickens.²⁵ These larger producers realize lower costs through the benefits of scale economies, while smaller producers pay higher production costs per unit and, as a result, are often less efficient.

Examples of consolidation and scale economies appear in many agricultural sectors: Since 1970, the U. S. has lost 85% of its hog farms, while pork production has risen by 16%.²⁶ The largest hog producers (those with more than 1200 breeding animals) have per unit costs of production roughly one-third less than smaller producers.²⁷ Cattle producers with herds over 1000 head have 30% lower production costs than those with the smallest herds.²⁸ Perhaps the most striking consolidation has occurred in the meatpacking industry, where the four largest firms handle 80% of U.S. steer and heifer slaughter, and 54% of the hog slaughter. Poultry concentration is a bit lower, with the four largest processors handling 49% of the slaughter.²⁹

Equally striking is the emergence of vertically integrated supply chains for food products that control the production of each intermediate input to the final product. In most cases, the integrator is a food company (for example, Smithfield Hams) that owns each link of the supply chain. Responding to consumer preference, food producers require better and greater information about the inputs into their production process. Most of the integration across agricultural supply chains takes place as food processors create contractual relationships with farmers to develop more consumer-oriented products and ensure product quality.

The poultry sector provides an excellent example of how consolidation and integration have transformed agribusiness. U. S. consumers favor chicken breast meat for its low fat content. In response, integrated poultry firms, like Perdue or Tyson, contract-out chicken production to farmers, supplying both chicks and feed. These firms

also establish quality control standards the farmers must meet. In addition, some integrated firms control breeding to maximize breast size and furnish an optimal diet to minimize fat content. The result is a finely developed consumer product, tight process control, and reduced cost.

Long-Term. World population is expanding at an extraordinary rate. By 2050, projections predict a global population approaching nearly 9.3 billion, up more than 50% from 2001.³⁰ World Gross Domestic Product (GDP) will continue to rise during this same period. Over the next twenty years, rising population and affluence will place ever-growing demands on the world's agricultural producers. With rapid technological growth and rising disposable income, consumers tend to improve their diets and desire more convenient, "value-added" nutrition sources. Consequently, U.S. agriculture can expect increased demand for meat, grains, sweeteners, and oils.³¹ By leveraging technology and by continuing to have access to international markets, U.S. agribusiness is in a good position to meet the increased demand.

GOVERNMENT GOALS AND ROLES

The United States government promotes several goals with respect to the agribusiness industry. These goals include keeping American agribusiness in a strong competitive position, feeding the nation's people, using food to aid people of other nations, promoting food safety, preserving the nation's environment, protecting natural resources, and preserving America's rural heritage. These goals are addressed in several pieces of legislation including the newly enacted Farm Bill. They are also advanced in the regulations of agencies such as USDA, the Department of the Interior, the Environmental Protection Agency (EPA), and the FDA.

The government plays several major and some supporting roles with respect to agribusiness. Just as the government uses legislation and agency regulations to promote agricultural goals, it uses these same mechanisms to fulfill roles to promote the industry and protect the public. For example, the USDA and FDA serve as guarantors of food safety. The USDA does this by inspecting grain shipment points, slaughterhouses, and other meat and poultry processing locations. The FDA performs its food safety role by testing and approving food products before they are marketed. The FDA also seeks to make sure ingredients used in foods are safe, and that food is free of contaminants such as disease-causing organisms, chemicals, or other harmful substances.³²

In contrast to the direct roles played by USDA and FDA, other agencies play more tangential roles. For example, the Occupational Safety and Health Administration (OSHA) serves as workplace safety monitor, the EPA is an environmental enforcer, the United States Trade Representatives Office (USTR) negotiates trade agreements, the Commerce Department promotes the industry abroad, the Department of the Interior's Bureau of Land Management (BLM) manages the allocation of leases for timber and government owned grazing land, and the Agency for International Development (USAID) oversees the dispensing of food products to needy people in developing countries. Taken together, the government significantly impacts agribusiness by performing a wide variety of major and supporting roles. However, the September 11,

2001 attacks lead us to evaluate the government's effectiveness in carrying out these roles.

Government Response to Terrorism

Last September's terrorist attacks prompted many people in and around American agribusiness to begin to focus greater attention on legislation and regulations related to food safety. Such scrutiny reveals tensions between claims by some for industry self-regulation versus the desire by others for greater government regulation. Debate has also focused around perceived government inefficiency and the value of direct government intervention in ensuring food safety and security. Agribusiness firms generally profess a preference for self-regulation of their products and processes. For example, the National Food Processors Association praised optional guidance that the FDA issued last year. The guidance was aimed at reducing the risks of food tampering and other terrorist acts. The Association praised the guidance largely because the FDA did not mandate compliance.³³ Similarly, grain exporters express frustration with the costs they pay for government inspectors from USDA's Federal Grain Inspection Service (FGIS). Their frustration is fueled by the fact that their desire for profit and survival in the industry motivates them to monitor the safety and quality of the grain they ship. In addition, although they must bear the costs for full-time, on-site government inspectors, their foreign competitors do not have to meet the same standards.

Food safety legislation before 9-11 was fragmented and consisted of what the GAO calls a "patchwork structure" of over 35 different laws.³⁴ This fragmentation in the legislative and regulatory framework hampers government efforts to address terrorist threats.³⁵ Last September's events resulted in a plethora of legislative and regulatory proposals dealing with food safety. Pending bills include proposals to increase funding to hire more food inspectors, increase port and border inspections for imported foods, create an agro-terrorism czar in the Office of Homeland Security, and consolidate food safety operations into one agency. Enacting some or all of these proposals could improve food safety enforcement or further complicate the bureaucratic structure.³⁶ However, we believe consolidating food safety responsibilities into a single agency deserves further study.

ESSAY:

THE IMPACT OF TECHNOLOGY ON AGRIBUSINESS

Introduction

"A farmer walks through his soybean field in central Illinois, heading for a spot pinpointed by a remote sensing image the farmer downloaded in that morning's email. Pest infestation in this small spot, indicated by a change in the "vegetative index," would not ordinarily be detected this quickly. Untreated, it could spread rapidly and destroy his entire crop. The farmer opens his palm-top computer, brings up information on the pest, completes an economic threshold analysis, and determines what control measures he will use. He records the exact location of the infestation using the integral global positioning

system (GPS) receiver and alerts his pest control advisor and custom pesticide applicator via cellular phone link.”³⁷

This scenario is not far-fetched nor is it science fiction. As in most industries, increased capabilities to process and use information are transforming agriculture. Today, information age technologies are reducing the cost of knowledge, enabling farmers to gather more data, analyze it with computers and apply it to their operations.

Agribusiness is at the cusp of an emerging role for exploiting technology to enhance production. Precision agriculture, or PA, is the “catch phrase” used to describe agricultural information technologies. The National Research Council defines precision agriculture as “a management strategy that uses information technologies to bring data from multiple sources to bear on decisions associated with crop production.”³⁸ Arguably, successful agriculture has always been information-based. The difference precision agriculture brings is the acknowledgement that conditions for agricultural production—soil, weather, prior management—vary across space and time. Farming success depends on making the right decisions in every aspect of crop production and marketing. Precision agriculture is a tool for ensuring that success. This essay briefly explores precision agriculture strategies and issues in agribusiness today. Further, it discusses some of the tools available to the farmer, and then concludes with the challenges associated with greater acceptance of precision agriculture.

Precision Farming

Strategies. Information is perhaps the modern farmer’s most valuable resource. Timely and accurate information is essential in all phases of production from planning through post-harvest. Information available to the farmer includes crop characteristics, soil properties, fertility requirements, weed populations, insect populations, plant growth response, harvest data, and post harvest processing data. Today’s available and emerging technologies are poised to redefine agribusiness in the future. Redefinition, though, is not just about technology, or improved capabilities for gathering data. The key is turning data into knowledge. An effective farm management strategy combines the information obtained and the available technology into a comprehensive system. Farmers must know how to interpret the information available, how to use the technology, and how to make sound production decisions. Precision agriculture turns data into decisions through data collection, analysis of the derived information, the addition of related knowledge, and the application of that knowledge and information.

Tools. Today’s farmer has many tools at his or her disposal for the collection, analysis, and application of data. Using these tools, the farmer can pinpoint his location in the field, collect data on that spot, and make informed production decisions. Available technologies to facilitate the farmer’s transition to precision agriculture include:

- **Global Positioning System (GPS).** GPS enhances data collection throughout the crop production process, providing the coordinates necessary for site or field specific maps. Differential correction, or DGPS, can pinpoint the farmer’s location within five meters.

- ***Geographic Information System (GIS).*** Precise positioning information is useless unless that information can be processed or analyzed. GIS is the principal technology used to integrate data collected from various sources and at different times, including financial, crop, and climate information.
- ***Direct Sensor Technologies.*** Data collection takes place throughout production. Using local sensing instruments mounted directly on farm machinery, the farmer is able to sample various attributes of soil, plants, air and water. These sensors include yield monitors, grain quality sensors, soil sensors, weather monitors and spectroscopy devices.
- ***Remote Sensing (RS) Technologies.*** RS technologies, such as aerial or satellite thermal images, can detect variations in soil, plant, and water conditions.
- ***Variable-rate Application Technology.*** Variable-rate application uses computerized controllers to vary rates of inputs such as seed, pesticides, and nutrients through planters, sprayers, or irrigation equipment.

Management Issues

The emphasis in precision agriculture today is to use technology to significantly improve crop management. However, to date, precision agriculture has not been widely accepted. The principle barriers to adoption are cost and education.

Cost. Still in its earliest stages, precision agriculture has yet to definitively demonstrate economic or environmental benefits. In a 1998 survey, nearly half of the farmers surveyed cited cost and uncertainty on return-on-investment as the primary barriers to buying precision equipment.³⁹ Current costs for precision agriculture are estimated at \$9-\$23 per acre; future costs are likely to drop. However, there is no conclusive data that ties expected benefits to the cost.

The promise of precision agriculture is the reduction of overall production costs through more efficient use of inputs (e.g. seed, fertilizer). Analysis by USDA's Economic Research Service shows that a 10% reduction in nutrient and pesticide applications for major field crops would reduce costs by only \$2.14 per acre, while a 10% increase in yield produces gains of \$11 per acre.⁴⁰ Clearly, the benefit to the farmer lies in increased production. In today's highly subsidized commodity markets, the benefit of higher production may not be worth the investment in high tech equipment. For example, in 2002, world cotton production will exceed consumption by about 5 million bales. There is little reason to invest in equipment that produces more cotton. In all segments, few farmers can justify the expense of buying technology for technology sake.

Education. Precision agriculture is computer-driven, and there is a clear link between adoption of PA practices and the education level of the individual farmer. In 1998, an Agricultural Outlook survey indicated younger and better-educated farmers were more likely to adopt PA techniques.⁴¹ Education also poses a problem from the employee perspective. In many agricultural segments much of the agricultural workforce is temporary and poorly educated. For example, cotton farmers rely heavily on unskilled migrant workers they employ roughly three months out of the year.

Conclusion

Precision agriculture represents one possible future for American farmers and agribusiness. Wide acceptance by farmers depends highly on technologies that pass the cost-benefit analysis. Farmers are unlikely to acquire technology for the sake of the technology itself. In order to gain widespread acceptance, precision agriculture must pass the test of time and demonstrate proven financial benefits to the farmer.

CAPT Kenneth Buell and Mr. Stephen Herlihy

ESSAY: AGRIBUSINESS'S LABOR CHALLENGE

Introduction

The supply and price of labor are critical factors in determining the viability of some sectors of agribusiness in the United States, while in other sectors, labor is a marginal to unimportant input. For example, this dichotomy can be seen on the production side in comparing vegetables to cereal grains. Vegetables tend to require significant amounts of labor, especially during harvest. However, cereal grains lend themselves to a tremendous level of technology application that has combined to increase yields and production while the percentage of Americans working on farms has fallen to historic lows of less than two percent. Similar trends can be seen in the processing side of agribusiness. The application of technology, particularly information technologies in the last ten years, has reduced labor forces significantly in areas such as baking and packaging while processing of fish remains relatively labor intensive. The overarching trend at work is to apply as much mechanization and technology as possible. For those sectors that do not lend themselves to mechanization, there will be an increasing pressure to move offshore where labor markets are not as tight.

Mechanization

U.S. agribusiness production has benefited from the same increases in mechanization as other industries. This is especially evident in cereal grains where a single farmer can now plant, nurture, and harvest the same amount of grain as would have required ten farmers in the early 20th century. In the pulp wood industry, harvesting involves essentially no lumberjacks. Fast growth trees are planted in rows and harvested by a machine that cuts the tree with hydraulic scissors, de-limbs it, and passes it overhead to a truck. Thus, two people have replaced an entire logging crew. The effect of this mechanization is reflected in huge reductions in farm employment. In 1935, there were 12.7 million persons employed on farms, today the number is 3.3 million people--including self-employed persons and hired labor.⁴²

The replacement of labor with mechanization is even more apparent in the processing side of agribusiness. For example, a large bakery producing cookies and snacks has seen its labor force decline from 2200 to 600 in the last 15 years. The bakery

could actually eliminate more positions by using information technology to automate oven temperature control, but the capital expense involved makes it more cost effective to retain employees to do this for now. Even the processing of live animals experienced a significant increase in automation. From the time a chicken is unloaded from the truck and hung on the production line until it is packaged in cellophane as pieces, it is hardly touched by human hands. The slaughter, feather removal, evisceration, and cleaning are all automated processes. Humans have involvement only in grading and sorting. Thus, a medium sized chicken processing plant has experienced about a four-fold decrease in the size of its labor force in the last fifteen years.

Grain farming, pulp wood harvesting, and chicken processing are just a few examples of how the large number of unskilled workers have been replaced by increasing levels of automation while the industry has become ever more productive. However, some sub-sectors of agricultural production have been bucking this trend toward automation. They are basically concentrated around the harvesting of fruits and vegetables, which remain labor intensive because of the difficulty in developing automated processes to gather the crop without causing damage. The labor is seasonal and based around crop harvest times so a large migrant work force has grown up moving from place to place. This labor force was historically composed of U.S. citizens, but in the last few decades has increasingly become dependent on foreign workers.

Foreign Workers

A 1997 GAO report estimated that 600,000 farm workers who are not legally authorized to work in the United States are nevertheless working on American farms.⁴³ This occurs because American citizens have other employment opportunities--either at higher wages or better working conditions. Not only are the foreign workers willing to work for lower wages than Americans, their illegal status makes them very unlikely to report abuses or unfair labor practices to government authorities.

The presence of these illegal aliens in the U.S. and their use as farm workers raises some important issues. First is the issue of security and counter terrorism. The existence of such a well-known and gaping hole in immigration control is a potential magnet for those seeking to do harm to the U.S. Next is the issue of respect for law. This is a nation based on law and each time we allow the law to be flagrantly violated we chip away at the very foundation of the country. The final issue is protecting the basic human rights of people working in the fields. The current system is rife with opportunity for abuse since there are strong disincentives for migrant workers to report abuse and unfair practices by employers. While it is certainly a minority of employers who would attempt to exploit workers, allowing this system to exist flies in the face of basic American values of fairness and concern for the individual.

Conclusion

Much of American agribusiness is moving toward reducing its reliance on labor. This movement is fueled by the desire to remain competitive by limiting the impact of relatively expensive labor costs as compared to trading rivals. The trend is made possible by increases in mechanization in the production and processing sectors of agribusiness.

While this trend continues to manifest, policy makers must consider how to deal with the displacement that occurs when those who previously depended on agribusiness jobs find that those jobs have vanished. The fact that a significant portion of the agribusiness labor force (at the farm level) consists of illegal foreign workers adds a layer of complexity to the policy dilemma.

Col Will Gunn and LTC Paul Hilton

ESSAY: THE AGRIBUSINESS FOOD SAFETY CHALLENGE

Introduction

The U.S. food supply is one of the safest in world, but it is not without vulnerabilities, and after September 11, 2001, the federal government and the agricultural community are keenly aware of agricultural bio-terrorism or “agriterrorism” and its potential devastation to the U.S. food supply, consumers, and economy. Agriterrorism is “the deliberate introduction of a disease agent, either against livestock or into the food chain, for purposes of undermining stability and/or generating fear.”⁴⁴ An act of agriterrorism at any point in the food chain could cause widespread harm: the destruction of millions of animals or plants, a loss of trade worth billions of dollars, rising food prices, and citizens’ loss of confidence in food safety and government protection could potentially threaten national survival itself.⁴⁵

Agricultural Vulnerabilities

While security intensifies at airports, power plants, and other forms of infrastructures, America’s farms remain among the industry’s most vulnerable targets. The sheer size of the industry along with limited resources and methods available for adequate defense present an infinite array of sources for terrorists to attack one of the nation’s most fundamental elements of power—agriculture.

There are various ways of conducting agriterrorism and they are relatively easy and cheap to introduce into any part of the agricultural system. Because of the nature of agricultural pathogens, it is difficult to discern whether an outbreak is the result of a deliberate act or a natural occurrence. For example, the Center for Disease Control (CDC) estimates that infectious agents that have not yet been identified cause more than three-quarters of the food-related illnesses and deaths in this country.⁴⁶ These infectious agents are responsible for an estimated 76 million illnesses and 5,000 deaths each year.⁴⁷ Therefore, deliberate acts may go undetected and be virtually free of reprisal but more importantly, the potential loss of confidence in the safety of U.S. produced food (or “food-fright”)⁴⁸ and resulting economic chaos pose even bigger threats.

Agriterrorism represents a significant economic threat to the U.S. For example, the USDA ran a simulation to see what would occur if foot-and-mouth disease made its way to the U.S. In five days, the disease would have spread to 25 states and economic

losses from such an event could total more than \$12 billion. This estimate is not far-fetched when compared to the \$2.7 billion in economic damage this disease caused in England. Similarly, a 1997 outbreak in Taiwan caused an almost immediate two percent drop in that country's GDP because of trade embargoes established by other countries trying to keep the disease out.⁴⁹

Similar incidences could occur with plants. For example, if soybean rust, a plant pathogen that normally does not exist in the U.S., were introduced here, it could spread from field to field or even state to state by the wind or insects, and the spores could survive to infect the following year's crop.⁵⁰ Not only would it damage the immediate crops, the supply of soybean meal, the main ingredient used for livestock feed and a major export item, could also be compromised. Therefore, an agriterrorism attack could have a devastating affect on the industry and the economy.

U.S. agriculture vulnerabilities are magnified due to the trend in U.S. farming toward not only increasing concentrations of livestock, which contributes to rapid spread of disease, but also increasing concentrations of crops and use of monocultures that make plants more susceptible to insects and disease. Actions such as using hybrid seeds that can resist pests and pathogens does not solve the whole problem⁵¹ Surprisingly, many imported hybrid seeds used in the U.S. come from only four countries, two of which—China and Iran—are suspected of having anti-agricultural warfare development programs.⁵²

Another significant agriterrorism risk is the security of the nation's laboratories that conduct research on animal disease. For example, the anthrax strain that caused outbreaks in Florida, New York and Washington, was identified many years ago at the National Animal Disease Center in Ames, Iowa.

Countering Agriterrorism

The threat of agriterrorism can be countered at four levels: (1) the organism level, through animal or plant disease resistance; (2) at the farm level, through facility management techniques designed to prevent disease introduction or transmission; (3) at the agricultural sector level, through USDA disease protection and response procedures; and (4) at the national level, through policies designed to minimize the social and economic costs of a catastrophic disease outbreak.⁵³ These divisions are not independent, nor can the threat be fully countered on one level. However, as suggested earlier, the most vulnerable level is America's heartland—the farm. Consequently, farmers must decrease the risk of disease of pest introduction through facility management methods to increase biosecurity.⁵⁴

For example, simple livestock security measures, such as isolating new animals from the rest of the herd to “incubate” potential agents and waiting for symptoms to appear, greatly enhance security. However, more than 85 percent of dairy farms do not isolate new cows from the rest of the herd for any length of time.⁵⁵ These measures reduce the chance a terrorist could introduce a disease into a farm facility; and, even if a disease is introduced, such measures also reduce the spread and help contain further outbreak.

Similar “best practices” are available to crop farmers. “History has repeatedly shown that a huge area planted with a single variety is vulnerable to a new matching

strain of pathogen or insect pest.”⁵⁶ Therefore, simple crop rotation and planting a diverse range of plant varieties help mitigate the introduction of disease or pests by terrorists. The more farmers can do themselves at the farm level to guard against a deliberate outbreak, the less likely and less vulnerable they become as targets for agriterrorism.⁵⁷ The first line of defense requires vigilance and diligence.

As mentioned earlier, physical security on large farms is difficult, but employing actions such as limiting access and controlling visitors will help decrease vulnerability. Finally, conducting tests of security systems, to include mock drills, needs to become as routine as feeding animals or plowing fields.⁵⁸ The American Farm Bureau, in their web-magazine On-line, re-enforced that farmers should take steps in preparedness such as “making sure they are in contact with their public health officials and officers in the fire and police departments.”⁵⁹ Developing a crisis action plan for handling potential situations and developing response procedures in the case of an event potentially prevents agriterrorism events and/or mitigates the severity of the event.

Going beyond production agriculture, throughout the food chain, safety can be enhanced by adopting the Hazard Analysis and Critical Control Point (HACCP) concept for ensuring food safety. “HACCP is designed to prevent food safety problems rather than to catch them after they have occurred. The first step, hazard analysis is a systematic study of a product, its ingredients, processing conditions, handling, storage, packaging, distribution, and directions for consumer use to identify sensitive areas that might prove hazardous.”⁶⁰ This concept is a major factor in assuring the safety and confidence of the processed food supply.⁶¹

Conclusion

While the U.S. can take some actions to reduce or mitigate the risk of agriterrorism, the agribusiness industry is so vast it is virtually impossible to completely protect the nation’s food supply. The biggest threat, other than actual food damage, however, is the psychological impact of real or perceived acts of agriterrorism and the resulting impact on confidence in the nation’s food supply.

Ms. Caroline Coleman and Mr. Stephen Herlihy

ESSAY: WORLD FOOD SECURITY AND U.S. NATIONAL SECURITY

Introduction

On March 14, 2002, President Bush announced a proposed increase to the U.S. foreign aid program, which includes food aid, of \$5 billion over three years. In making his announcement, the President said, “We work for prosperity and opportunity because they’re right; it’s the right thing to do. We also work for prosperity and opportunity because they help defeat terror.”⁶² These comments clearly capture two aspects of the U.S. aid program. The first is humanitarian. The second is the program’s contribution to

U.S. national security. Although the humanitarian element has always been self-evident, September 11, 2001 raised America's consciousness that hunger and poverty breed fertile ground for the recruiting of terrorists that could directly threaten U.S. homeland security. This essay considers the link between world food security and terrorism, describes current food security issues and challenges, and then provides some concluding thoughts on the world food security component of the U.S. national security strategy.

Food Security

Food security was defined by the World Food Bank/World Food Program in *Food Aid in Africa: An Agenda for the 1990's* as: "... access by all people at all times to enough food for an active and healthy life entailing adequate food supplies through domestic production or imports and ensuring that people who suffer from under nutrition can acquire food by producing it themselves or by buying it."⁶³ When we speak of food security we are concerned not only with conditions of hunger and malnutrition but also with poverty as a root cause of those conditions. But what is the link with terrorism?

In a February 2002 interview, Andrew S. Natsios, the administrator of the U.S. Agency for International Development (USAID), explained that failed states lend themselves to an atmosphere that can be taken advantage of by terrorists. People, particularly young men in their 20s, who are in refugee camps or internally displaced camps, have no jobs and nothing to do, are readily recruited by terrorist organizations. Improving world food security is therefore an important step in preventing the conditions that can contribute to the rise and recruiting of extremists and terrorists.

The need for food security in the developing world is staggering. According to the UN Food and Agricultural Committee, 792 million people, or 18 percent of the population of the developing world, were undernourished in 1996-1998. Of the 792 million, 174 million were children under five. Sixteen of the 35 countries that faced food emergencies in 2001 were in Sub-Saharan Africa. The gravest problems were in Afghanistan, Mongolia, and the Democratic People's Republic of Korea.⁶⁴

A Texas A&M University study, conducted in 2001, concluded that food production in the developing world will not keep pace with demand. Cereal import demands are expected to almost double by 2020 to 192 million tons, largely in areas where food insecurity is most rampant.⁶⁵ Underlying this conclusion are several factors including conflicts that disrupt production, growth in world population (which is expected to double in the next half century), and a demand driven "livestock revolution"⁶⁶ as countries with rising living standards consume more meat (it takes eight kg of grain to produce one kg of beef). Quite simply, there are large regions of the world where people can't produce enough food for themselves and are too poor to purchase the balance of their needs from other nations.

Food Aid and the UN World Food Program

The 1996 World Food Summit set a goal of reducing the number of undernourished people in the world by half by the year 2015. The United Nations frontline agency for food aid is the World Food Program (WFP). Its task is to feed the hungry poor and help them break the cycle of hunger and poverty.⁶⁷

Since 1995, the WFP has emphasized the needs of women and girls. The WFP currently delivers about 60% of its aid to women.⁶⁸ It has been shown that educating girls is one of the wisest and most profitable investments a country can make. For example, new research conducted by the International Food Policy Research Institution concluded that improvements in women's education accounted for almost 45 percent of the total reduction in child malnutrition between 1970 and 1995.⁶⁹ One underlying factor is that educated and emancipated women know how to space their pregnancies.⁷⁰ As reported in the *UN Chronicle*, "The WFP has developed an innovative way of using food aid to help educate girls in the developing world by distributing basic food items, such as a sack of rice, to families in exchange for the schooling of their daughters."⁷¹

Although food aid may help relieve hunger and malnutrition in the short term, achieving food security requires long-term improvements in food productivity and distribution.

Food Productivity and Distribution

Increased production is critical to food security in the developing world. This is especially true at the small-farm level. Three current approaches to increasing the productivity of small-scale farms are using agroecological approaches (which relies on the use of organic material and improved farm management to reduce physical inputs such as fertilizers, pesticides, water), employing biotechnologically altered seeds, and applying precision farming techniques.⁷² Knowledge and technology transfer are at the heart of all three approaches.

While technological advancements offer great promise for increasing world food production, distribution is a critical component of world food security. Poor transportation and communications infrastructures impede the free flow of food in developing countries. This has two food security consequences. First, the distribution of food aid is hindered. For example, the WFP must work with more than 1,000 non-governmental organizations to build new roads and bridges, and even rehabilitate entire ports and runways to deliver the food to the right people.⁷³ Second, development of a country's internal agribusiness industry is impeded. A recent Farm Foundation paper even suggests that "programs designed to improve the handling and distribution infrastructure, especially in the poorest countries, may do as much to enhance food security and meet international food aid needs as increasing available food supplies."⁷⁴

To achieve food security for their people, governments in the developing world must provide leadership in establishing the conditions required for success. They must support the education of their people, allow access to technologies that improve productivity, and invest in distribution systems. These nations must also make the overarching reforms in areas such as the rule of law, private property ownership and security of investments to truly succeed in the global economy.

There has been a dramatic increase in the role played by the private sector in providing the needed assistance. According to Mr. Natsios, "only 20 percent of all capital flows to the developing world come from official development assistance from donor governments. Eighty percent of the money is now private money."⁷⁵ The sources of the private money are large foundations like the Gates Foundation, funds raised by

non-governmental organizations, universities working with the developing world, and private companies making business investments.

The Economics of Food Security from a U.S. Perspective

Since the mid 1980s, U.S. exports of bulk commodities have trended downwards, whereas exports of high value food products have trended upwards. The export dollar value of high value products has in fact been higher than that of bulk commodities since 1990.⁷⁶ It would appear from this that U.S. investment in programs that establish bulk commodity production in the developing world may provide dividends by creating a huge developing world market and by increasing the developing world's purchasing power. This increased purchasing power could be used to buy the more profitable high value food items produced in the U.S. With this in mind, provided the U.S. maintains adequate commodity production for its own needs, assisting the developing world may contribute not only to U.S. physical security but also, in the long run, to U.S. economic prosperity.

Conclusion

World food security can contribute to the long-term war on terrorism by preventing the conditions that can contribute to the rise and recruiting of extremists and terrorists. The U.S. national security strategy should therefore include a commitment to improve world food security by: (1) Participating in food aid programs, especially those focused on the nutrition and education of women and girls; (2) Transferring agricultural knowledge and technology; (3) Improving distribution infrastructures; (4) Promoting private sector engagement and initiatives; (5) Encouraging governments to make reforms in areas such as the rule of law, private property ownership, and security of investments; and (6) Focusing on the long-term benefits of world food security to U.S. physical security and economic prosperity.

Col Ron Howard

CONCLUSION

Today, the agribusiness industry is undergoing profound technological and structural change. Yet, at the same time, agriculture and its related industries remain a vibrant and important element of the U.S. economy, providing a cornerstone to our nation's security strategy. The U.S. continues as the world leader in food production and maintains the ability to feed its population and contribute to the requirements of a growing world food demand. While the state of American agribusiness is strong, there remain several challenges the U.S. must address in the interest of national security.

First, the U.S. must develop and implement gradual reductions in tariffs and subsidies, and adopt policies that promote free trade. Current U.S. policy endangers the viability of important export markets, and an important economic sector that accounts for 16 percent of the U.S. gross domestic product.

Second, the U.S. government must refine its food safety role, and address the security of the nation's food supply in the post-September 11 environment. Across the agribusiness industry, the awareness of potential food supply contamination, acts of terrorism, or the potential for other criminal behavior has taken hold. Due to the nature of the business, agriculture is generally responsive to various threats to the food supply system. However, the government's food safety legislation is a "patchwork" of laws controlled by a myriad of governmental agencies.

Third, the U.S. must leverage its food production capability and capacity to enhance its role in world food aid. Relieving suffering where possible and easing discontent in volatile regions of the world should be a top U.S. priority. The U.S. must develop a unified strategy using aid and assistance as a tool to influence the actions of other nations and their policy decisions.

Finally, the U.S. must encourage increased agricultural research and development—both directly, through agencies like the USDA's Agricultural Research Service, and indirectly, through grants to universities. Increased research into robotics, precision agriculture techniques, and biotechnology provides the path to a more efficient agriculture system characterized by less manual labor, and higher yield crops that require less water, nutrients, and pesticides.

Overall, American agribusiness continues to be a source of internal strength and external influence. The future of U.S. and world agriculture is promising, yet uncertain. The promise lies in the leadership capabilities of the United States, and the effective application of available technologies. The uncertainty arises from a rapidly expanding world population, diminishing resources, and inequities in food distribution. The United States must recognize the challenges facing this vital industry, and develop a cohesive national security strategy that understands and appreciates agribusiness's global role.

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